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Seed Predation of Mammals Granivory in Different Microhabitats of Tallgrass Prairie

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The Assignment: Author a paper describing a field-based experimental research project.

Key words: foraging; GUD; microhabitat; *Microtus ochrogaster*; *Microtus pennsylvanicus*; *Peromyscus leucopus*; prairie; seed predation.

Introduction

Predation, or the way food is obtained, is important to the survival of numerous species. Generally, food is not easily accessible, causing many mammals to spend much of their waking time looking for nourishment. This time can take away from other activities, such as reproduction or training their young. However, food is important to the survival of living things. Sometimes an organism may find a region where there is an abundance of food. This creature, which was used to spending its waking days trying to obtain enough food, now has an enormous amount of food ("Mouse (Rodents)." 2002). How does this organism react? It is possible that it will decide to eat as much as it can, and hope that the left over food will still be there the following day. However, maybe the organism will instead take an excess of the food and store it. The amount of food remaining is called GUD, or giving up densities.

Due to the fact that this experiment was conducted during the night, it is more likely that small mammals would be foraging for food. Experimenters and observers have identified various creatures occupying the tested location in this experiment. One common mammal found, in the tested site for this experiment, is the mouse. In the past, some species of mice identified included *Peromyscus leucopus* (common name is white-footed mouse), *Microtus pennsylvanicus* (common name is meadow vole), and *Microtus ochrogaster* (common name is prairie vole). *Peromyscus leucopus* is very successful in various environments. Many of the white-footed mice have been known to reproduce year-round. *Microtus pennsylvanicus* has had a dramatic decline in population. Many have suggested that this may be due to the lack of vegetative cover. This has been considered because where livestock grazing has kept the grass short there has been a decline in the amount of meadow voles found. *Microtus ochrogaster* is closely related to the meadow vole in regards to what they eat and where they are found in the world (Alderton 1999).

Mice spend a great amount of their life looking for food. They usually eat seeds or diverse insects. Many build burrows as nest in prairies. These burrows can be a place to hibernate, store food, and nourish young offspring ("Mouse (Rodents)." 2002). Mice spend a great amount of time looking for food because they usually are not surrounded by enough to survive on a daily basis. Luis Marone, Javier Lopez de Casenave, and Victor R. Cuerto did an experiment in the Monte Desert (2000). This experiment was conducted in South America, in an area with a small rodent population. The experimenter's goal was to see the different foraging patterns of ants, mammals, and birds. They used three different food preparations for the different organisms. Many of the foragers were believed to be rodents. The experimenters reached the conclusion that in order to achieve accurate results for the testing of mammals, in this region; they would have to do this experiment for a longer period of time. This suggests another factor in the predation of organisms. This factor is the time of year in which the organism eats. It is possible that organisms eat only in a certain season and than store excess food in the following season. However, it is also possible that certain organisms forage year round (Cuerto, De Casenave, and Marone 2000).

A field study carried out by Maxine F. Miller was conducted in the winter and summer. This was done in order to obtain accurate results due to the fact that foraging is not always consistent during different seasons. Miller found that there was a difference in the seed consumption in the different seasons, winter and summer. There were significantly more seeds eaten in winter compared to summer (Miller 1994). One suggestion for this is that there is more available food in the summer compared to the winter.

In this experiment there were many concepts considered in the foraging of mammals. One concept tested was the location. Usually if mammals want to stay safe from predators it would seem beneficial for the mammal to forage and eat in the covered area. However, much of this experiment is taking place at night. There may not be a need to hide from predators compared to if these animals were foraging during the day. Perhaps there is a decrease in the amount of nocturnal predators compared to the amount of predators during the day. Therefore, it is likely that there will be more food left over in the covered area. Another factor looked at in this experiment was the type of seeds; sunflower or small, mixed seeds, eaten. Although the sunflower seeds contain more nourishment, these seeds may appear more foreign to the mammals because they are not use to them. Also they may find these seeds harder to eat. Therefore, it is possible that more of the smaller seeds will be eaten.

Methods

Experimental Locations:

The test site took place at the Russell R. Kirt Prairie, located on the College of DuPage campus. College of DuPage is located in Northeastern Illinois. The Russell R. Kirt Prairie is about eighteen acres. It contains approximately six acres of marsh and eleven acres of reconstructed prairie and savanna. This prairie was planted and replanted between the years 1984-2000. The tall grass is called Mesic Tall Grass. The Russell R. Kirt Prairie contains herbaceous plants with dominant warm season grasses. This prairie also contains about one-acre of pond. Figure 1 shows a map of the experimental location ("Visitors Guide: Natural Areas").

In this experiment there were two types of sites examined. One site was a tall grass area, and the second site lacked grass growth. The tall grass site is considered the covered area, and the site with lack of grass growth is considered the open area. The other factor examined was the type of seeds eaten. In one Petri dish there were large seeds called black oil sunflower seeds. The second Petri dish had small seeds called thistle, millet seeds.

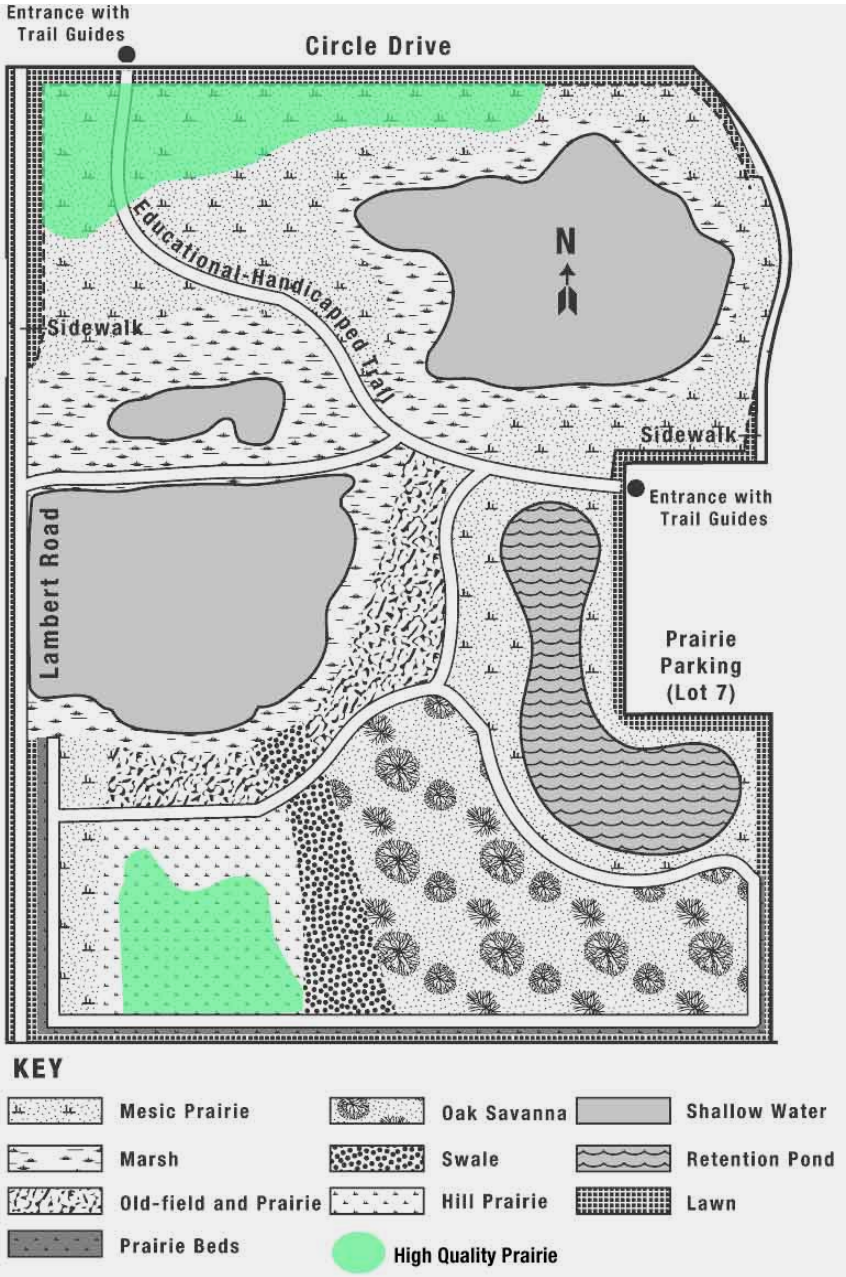

Figure 1 This map shows the experimental location. The experiment took place at the Russell R. Kirt Prairie on the College of DuPage campus.
Map courtesy of www.cod.edu

Foraging Experiment:

This experiment was arranged at six-thirty in the evening. Before arriving at the experimental location, a total of one hundred and twenty Petri dishes were set up. Sixty of these Petri dishes contained five grams of large (sunflower) seeds mixed with sand. The other sixty Petri dishes contained five grams of small (thistle, millet) seeds mixed with sand. There were four locations, two sites contained low or no growth (open area) and two sites contained dead standing stalk (covered area) from the prior year. Each of

these four sites contained thirty trays, fifteen Petri dishes of large seeds and fifteen Petri dishes of the small seeds. In each site a pair of Petri dishes, one containing large seeds and another containing small seeds, were placed about one meter from each other. Each pair of dishes was placed at least three meters apart from another pair of dishes. The goal of this was to have the Petri dishes semi-randomly placed. The Petri dishes were mixed with sand in order to make the experiment as realistic as possible. The dishes were also pinned to the ground, with wire, in order for less spillage to take place. The following day, at six thirty in the morning, the trays were collected in all four sites. These dishes were brought to the laboratory. Due to the fact that this experiment was conducted in the early spring, there was some precipitation. Therefore, the seeds were left to air dry. They were not put in an oven to dry because this could cause the contents of the seeds to be altered affecting the data. Once the seeds were dry, they were weighed to calculate GUD's.

Data Analysis

The dependent variable in this experiment is the GUD value. The analysis used, in order to interpret whether the GUD was significant or not, was ANOVA. ANOVA is an analysis of variance. The results that contained a probability value of 0.05 or lower was considered significant.

Results

According to the ANOVA results, this experiment produced some significant outcomes. One significant factor in this experiment was the microhabitat. The microhabitat is considered significant because the probability value, of 0.0002, is less than 0.05. Figure 2 supplies more statistical analysis using ANOVA. One aspect of this experiment that was not considered significant, according to the probability factor of 0.05, was the seed size. The probability value for the seed size was about 0.1230. The microhabitat and the seed size together had a probability of about 0.0264. Thus, the microhabitat and the seed size were significant factors for the GUD value.

All the Petri dishes contained about five grams of seeds before they were placed in the prairie. Following the experiment, the average GUD for the large and small seeds in the covered site was about 3.4 grams and 4.3 grams. The average GUD for the large and small seeds in the open site was about 4.9 grams and 4.8 grams. Therefore, the smallest value for GUD was the large seeds in the covered sites, and the greatest amount of GUD was the large seeds in the open sites. This is summarized in Figures 3.

ANOVA Results	***NOTE*: Results are significant if P has a value of 0.05 or lower.**	
Microhabitat (Open vs. Close)	F(1, 116)= 19.96	P= 0.0002
Seed Size (Large vs. Small)	F(1, 116)= 2.41	P= 0.1230
Microhabitat x Seed Size	F(1, 116)= 5.06	P= 0.0264

Figure 2 This table displays the ANOVA results. It is comparing the GUD in relation to seed size and experimental location.

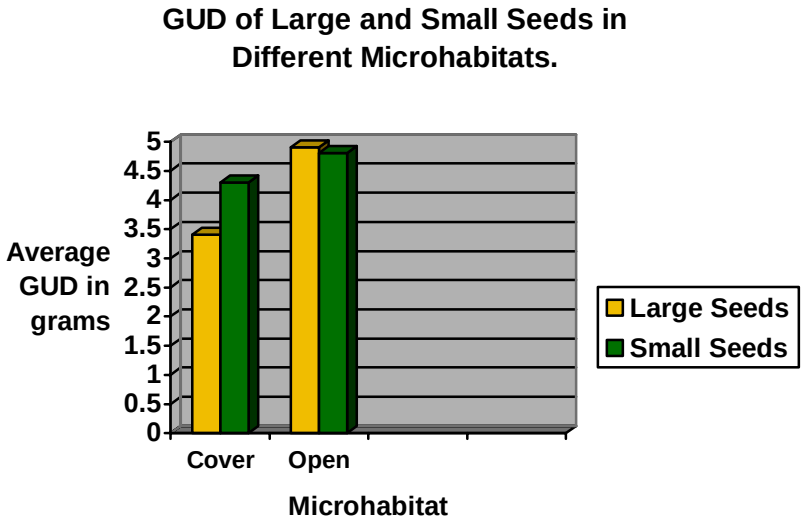

Figure 3 Average GUD under two variables. Variable one is the difference in seed size, large and small. The second variable is covered and opened areas for foraging.

Discussion

According to the results, the seed size was not a significant factor overall in regards to GUD. It was stated in the introduction that it would seem more likely that smaller seeds would be eaten. This was suggested because the mammals eating the seeds may be more used to finding these types of seeds while foraging for food. Also, it was thought that the larger seeds would be harder for the mammals to eat. Nonetheless, the mammals eating the seeds did not have a preference on seed size. This may have been because the mammals took the first seeds they found. However, this does not seem likely because the pairs of seeds were not a great distance apart. Another idea that may have caused the seed size not to appear significant was that perhaps different mammals ate certain seeds. It is possible that by coincidence there was an equal amount of large seeds eaten by one species compared to small seeds eaten by a different species.

One aspect of this experiment that was significant was the location of the foraging. It was stated in the introduction that it would seem more likely that a greater amount of seeds would be eaten in the open area. This was hypothesized because it appeared less likely that mammals would need to hide from prey at night. However, there was a twenty percent less GUD value in the covered location compared to the open location. According to the research, previously stated in the introduction, mice are known to thrive in areas of cover. Statistics have shown that locations that have lacked cover have had a decrease in their mice population (Alderton 1999). Therefore, it is possible that more mice are found in covered areas. However, many other factors could be taken into account in regards to the significance of the GUD value. For example, it is likely that more spillage of seeds took place in the covered areas. This could have adjusted the data.

The results showed that location had significance in the GUD value over the seed size. If this experiment was to be tested in the future one concept that should be looked at is the amount of time in which the experiment took place. This experiment was conducted for twelve hours, one night. In order to get more accurate results one could conduct this experiment from 6:30 in the evening to 6:30 in the morning, for possibly fourteen days or more. Another issue that could be looked at, if this experiment was

tested in the future, is what animals are eating these seeds. By past experience one is assuming that mainly mice are eating the seeds. However, it is possible that other living creatures are eating the seeds. By using a video camera an experimenter would be able to see what organisms are foraging.

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